NUCLEAR REACTION DATA FOR IBA APPLICATIONS

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Main aspects are discussed concerning nuclear reaction cross-sections for PIGE analyses, especially referring to cultural heritage diagnostics, within the framework of ion beam analysis (IBA) methods, also reviewing main results from recent international Conferences on Nuclear Data for Science and Technology and from NEA-NSC meetings and IAEA initiatives on the matter. In particular, within the frame of an overall summary on nuclear data requirements for IBA applications, main needs are pointed out specifically referred to the PIGE diagnostics purposes of present interest. Particularly, nuclear data relevant to light-element analysis in archaeometry are specifically considered and their impact on the knowledge and conservation of the cultural heritage is pointed out, especially discussing most significant examples concerning the beneficial use from the evaluated nuclear data on the results obtained by the application of this nuclear analytical technique. Consistently, relevant topics are discussed concerning the evaluation of the requested nuclear reaction data, on the basis of the existing experimental values and nuclear model calculations, according to the appropriate parameterisation and the consequent effects on the calculation results. Particularly, theoretical models on the nuclear structure and for estimation of the nuclear level densities are discussed, such as the modern algebraic models and the microscopic superfluid models, with emphasis on their influence on the calculations of photon production data, especially referring to the effects on the semi-empirical level density formula normally adopted in cross-section calculations, mainly to the parity-breaking effects and to the dependence of the most crucial level density parameter on the nuclear excitation energy. Accordingly, recent results are presented as obtained for (p,xγ) reaction data, by comparing critically selected experimental data and the relevant model calculations, with regard to significant isotopes of low- and medium-mass elements of actual interest when considering alloys and other fabrication techniques for ancient manufacts.

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